there, the theory of sets of points comes into the argument. Abundant references are given to original sources, and in every respect this course seems to be an admirable guide for those who feel inclined to explore this very important, though thorny and still undeveloped, field.

G. B. M.

CHEMISTRY: PURE AND APPLIED.

(1) *Geschichte der Chemie von den altesten Zeiten bis zur Gegenwart zugleich Einfuhrung in das Studium der Chemie. Vierte Auflage.* By Prof. Ernst von Meyer. Pp. xiv+616. (Leipzig: Veit and Co., 1914.) Price 13 marks.

(2) *Chemistry and its Borderland.* By Dr. A. W. Stewart. Pp. xii+314+11 plates. (London: Longmans, Green and Co., 1914.) Price 5*s*. net.

(3) *Industrial Chemistry for Engineering Students.* By Prof. H. K. Benson. Pp. xiv+431. (New York: Macmillan Co.; London: Macmillan and Co., Ltd., 1913.) Price 8*s*. net.

(1) SINCE the date of the first edition in 1888, Prof. v. Meyer's History of Chemistry has been the fullest account of the progress of the science, and most of the present-day chemists owe much of their knowledge of the work of their predecessors to its perusal. In the earlier editions the work of individual chemists was given under their respective names, and it was difficult for the reader to get a clear idea of the development of chemical theory as a whole. In this respect it was inferior to the shorter histories of Wurtz and Tilden, in which the individual workers are mentioned indeed, but their work forms a continuous narrative. In the later parts of this new edition this defect has been largely removed, but without re-writing the whole book it could never be made into a history from which a student could obtain a clear idea of the way in which our present idea of chemical theory had been arrived at. Historians will undoubtedly differ in their estimate of the importance of the several branches of their subject, and probably no two chemists would agree as to the proportion of attention which should be given to any one branch. For instance, it would seem unnatural to many that only three pages out of six hundred should be devoted to Mendeléeff's periodic classification of the elements, the only great generalisation which binds together the otherwise disconnected facts of inorganic chemistry, and that the important additions which Sir J. J. Thomson (spelt Thomsen) has made to chemical science should be dismissed in two lines.

(2) It is difficult to imagine for what class of readers this book is intended. An attempt to teach the final conclusions of a complicated and difficult science in a book of 300 pages, starting *ab initio,* is foredoomed to failure. To the country clergyman who wishes to keep "abreast with the times" it may do no great harm, but it is to be hoped that it will never be given as a prize to a promising schoolboy. A statement like "Inorganic chemistry now includes the chemistry of all the compounds which do not contain any carbon," may be a slip, but the description of the discovery of argon is an untrue representation of the facts. There is a whole chapter on the transmutation of the elements in which the case for transmutation is stated at great length, while the barest mention is made of experiments on the other side. Collie and Patterson have maintained a most praiseworthy reserve as to the conclusions to be drawn from their experiments, and the author would have done well to imitate their reticence.

(3) Of the importance of a knowledge of chemistry to engineering students no one now has any doubt. All the most eminent engineers when consulted as to the curriculum of an engineering school, have emphasised the absolute necessity of the inclusion of an adequate chemical training. In spite of this at least two universities in this country ignore the subject for their engineering students, partly because the authorities consider that the course is already too extended, and partly because it is sometimes difficult to persuade the students of the importance of knowing the character and properties of the materials with which they will have to work. In the best engineering schools, however, the students have a preliminary course of pure chemistry during their first year, followed in the next year by a course of more technical chemistry as applied to engineering. This consists of three principal divisions: (1) Fuels of all descriptions and their modes of application; (2) metallurgy, including the composition and properties of alloys; (3) water in relation to boiler practice, cements and protective materials and coatings.

Prof. Benson has expanded his lectures to engineering students in the University of Washington into the book under review, and judging from it the young American engineer has a chemical training similar to that given to our own students. It is always a matter of difficulty to make a book from lecture notes, and it must be admitted that this one is not free from the defects which are seen in most other books produced in similar circumstances. Most of the descriptions of plant and apparatus are too brief to indicate the way in which the apparatus works, and in many cases a diagrammatic representation would

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have been much more illuminating than reproductions of photographs of the outside of the machines. Apart from this defect, which would be corrected by a good lecturer, we have nothing but praise for the book. The chapters on hydraulic cements are particularly good, and there is also a good description of industrial alloys.

LIFE AND ITS INTERPRETATION.

(1) *Les Inconnus de la Biologie déterministe.* By A. de Gramont Lesparre. Pp. 297. (Paris: Felix Alcan, 1914.) Price 5 frs.

(2) *Einführung in die Tierpsychologie auf experimenteller und ethologischer Grundlage.* By Gustav Kafka. Erster Band. Die Sinne der Wirbellosen. Pp. xii+594. (Leipzig: J. A. Barth, 1914.) Price 18 m.

(3) *L'Espèce et son Serviteur.* (Sexualité, Moralité.) By Prof. A. Cresson. Pp. 347. (Paris: Librairie Felix Alcan, 1913.) Price 6 frs.

(4) *Life and Human Nature.* By Sir Bampfylde Fuller. Pp. xii+339. (London: John Murray, 1914.) Price 9*s.* net.

(5) *Controlled Natural Selection and Value Marking.* By J. C. Mottram. Pp. ix+130. (London: Longmans, Green and Co., 1914.) Price 3*s.* 6*d.* net.

(1) A. DE GRAMONT LESPARRE makes a very eloquent protest against determinist biology which has no use for the soul. He indulges in not a little sarcasm at the expense of those who regard the psychical life as an epiphenomenon of cerebral metabolism, and hold that physics and chemistry are sufficient, or will eventually be sufficient, for the description of an animal's daily life. He considers sensation, memory, heredity, reproduction, instinct, intelligence, and so on, and shows that the way of determinist biology is hard. Instead of clearing things up, it lands us in an intellectual fog. He will not have anything to say to "psychoids" and the like, but stands for the old-fashioned soul, an active intellectual principle, simple and autonomous, existing alongside of or rather above physiological phenomena. It is well that the difficulties in the way of mechanistic interpretation should be firmly pointed out, and the author's passionate eloquence need not be taken amiss in these days of compromise; it is well to point out the dangers of question-begging phrases like "the life of crystals," and "the memory of a twisted thread"; it is also well to proclaim the inestimable value of the concept of personality; but we think it far from well that one of the author's standing should give in the closing pages of his book an account of the present state of the theory of organic evolution which we do not hesitate to call a pessimistic and reactionary misrepresentation.

(2) Dr. Gustav Kafka has done an admirable piece of work in bringing together in a synoptic, rather than encyclopædic manner, what is known in regard to the senses of invertebrates. It is the first volume of an introduction to animal psychology, and it raises our expectations for what is to follow. The book is clear and scholarly, and it does not lose sight of the wood in studying the trees. It deals with touch, equilibration, hearing, sensitiveness to temperature, to chemical influences, and to light; and ends with "space-sense" (as in homing) and "time-sense" (as in rhythmic movements), though the author admits that these two titles are scarcely justifiable psychologically. The book has abundant and interesting illustrations, but some of them are a little rough. There is a useful, well-selected bibliography. As to the author's general position, he believes strongly in physiology and psychology minding their respective businesses. The physiologist has to work at the series of spatial happenings between the stimulus and the reaction; the psychologist has to work out a subjective description. Just as a chemist would not be warranted in postulating a magician because he did not follow some of the steps in a long and complicated series of reactions, so the physiologist must not postulate a psychoid factor in his nexus between stimulus and response. But the psychologist need make no apology for working out a different kind of description, equally necessary, and certainly not less real. He must keep close to the observed facts of behaviour, but in his psychological account of these he need not allow himself to be too much hindered by the difference between the nervous organisation of the lower animal and that which he himself possesses. There may be analogous psychical life though the anatomical architecture is quite different. A snake can move very effectively, though it has no limbs.

(3) The aim of Prof. Cresson's admirable book is to emphasise the extent to which organisms are adapted for securing the welfare of their race. In their multiplication, in their reproductive processes, in their parental care, individuals do much that is not to their own advantage; their personal interests have been subordinated to those of the species. They are borne on by impulses and instincts which are as compelling as hunger and thirst, but apart from sexual gratification (which applies only to a relatively small number of cases) the fulfilment of these impulses and instincts is often of little individual advantage. Indeed,

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